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OBSERVATIONS ON *AZPEITIA NEOCRENULATA* (VANLANDINGHAM) FRYXELL & WATKINS (BACILLARIOPHYCEAE) FROM CHILEAN MARINE WATERS

OBSERVACIONES SOBRE AZPEITIA NEOCRENULATA *(VANLANDINGHAM) FRYXELL & WATKINS (BACILLARIOPHYCEAE) DE LAS AGUAS MARINAS CHILENAS*

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ABSTRACT

This paper reports the results of a study about the morphology of individuals belonging to the genus *Azpeitia* M. Peragallo collected in the South Eastern Pacific Ocean at 38°58'S-74°12'W. This material is more related to *Azpeitia neocrenulata* (VanLandingham) Fryxell & Watkins, a warm water species, than to the subantarctic species *A. tabularis* (Grunow) Fryxell & Sims.

KEYWORDS: Bacillariophyceae, *Azpeitia*, Chile.

RESUMEN

En este trabajo se entrega los resultados de un estudio acerca de la morfología de representantes del género *Azpeitia* M. Peragallo, recolectados en el océano Pacífico suroriental (38°58'S-74°12'W). Este material es más cercano a *A. neocrenulata* (VanLandingham) Fryxell & Watkins, una especie de aguas cálidas, que a *A. tabularis* (Grunow) Fryxell & Sims, taxon propio de las aguas subantárticas.

PALABRAS CLAVES: Bacillariophyceae, *Azpeitia*, Chile.

INTRODUCTION

The genus *Azpeitia* was established by M. Peragallo (in Tempere & Peragallo, 1912) from fossil material collected in Spain. Recent studies on this genus have relocated many species of *Coscinodiscus* to *Azpeitia* (Fryxell *et al.*, 1986; Sims *et al.*, 1989).

At present, *Azpeitia* is basically characterized by i) its strongly silicified frustules, ii) a conspicuous difference in the areola patterns on the valve face and the mantle, iii) a large, subcentral labiate process on each valve, positioned at the edge of an annulus or thickened ring that can include areolae, and iv) a ring of large labiate processes located between the valve face and the mantle. Although this genus presents some characters in common with the Coscinodiscaceae, Fryxell *et al.* (1986) and Sims *et al.* (1989) consider the Hemidiscaceae the best place for *Azpeitia* if it is to be treated as a separate family from the Coscinodiscaceae.

The genus is typically oceanic (Sims *et al.*, 1989), and includes fossil (about 19 taxa) and living planktonic species (5 taxa) found principally in tropical and subtropical marine waters. However, *A. tabularis* (Grunow) Fryxell & Sims, one of the living species, is confined exclusively to subantarctic and antarctic waters.

During a routine analysis of phytoplankton samples, we found the Genus *Azpeitia* present in material recently collected from the South Pacific Ocean off the coast of Chile, at 38°58'6"S-74°12'4"W. In this paper, the morphology of this taxon is described using light and scanning electron microscopy. The findings reveal that this taxon is more closely related to that of a warm water species (*A. neocrenulata* (VanLandingham) Fryxell & Watkins) than to the typical subantarctic taxon *A. tabularis* (Grunow) Fryxell & Sims.

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MATERIALS AND METHODS

The net sample studied was collected in 1960 off the coast of Chile during the oceanographic expedition Mar Chile I (39°58'6"S-74°12'4"W, 15.03.1960, St. 97, near-surface horizontal net tow). This sample is deposited in the Diatom Collection, Department of Botany, University of Concepcion, Chile with the numbers DIAT-CONC M-838, and DIAT-CONC 2212. The sample was treated for the removal of organic matter according to the method described by Hasle and Fryxell (1970). The light microscope used was a Zeiss Photomicroscope III; the electron microscopy photographs were taken on an ETEC Autoscan U-1 at the Laboratory of Electron Microscopy, University of Concepcion. Terminology followed in the description corresponds to that suggested by Anonymous (1975) and Ross *et al.* (1979).

RESULTS

Only two valves of the genus under study were observed (one with light microscopy and the other with SEM, internal view). All efforts to recover more individuals from the same sample, or from other 25 samples from the region, failed.

Light microscopy

The valve has a diameter of 24.5 µm, the valve surface is flat and the valve margin has a crenulated appearance. The areolae on the valve (11-13 in 10 µm) tend to be fasciculated; at the center there is a cluster of 13 areolae surrounded by a narrow hyaline area. A second hyaline ring is located between the valve and the mantle. One subcentral labiate process and a marginal ring of labiate processes (5-6 µm distant) are very conspicuous on the valve. The areolae on the mantle are very small, about 19 in 10 µm.

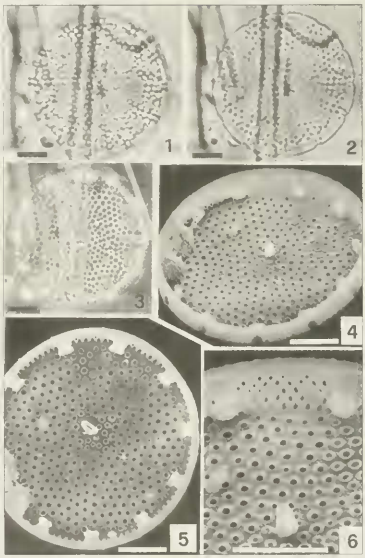

Fig. 1, LM, areolae tend to be in fascicles. Fig. 2, LM, valve margin with a crenulated appearance and very conspicuous labiate processes. Fig. 3, LM, a cluster of 13 areolae at the center of the valve, marginal hyaline ring between the valve face and the mantle. Fig. 4, SEM, large central and marginal labiate processes, note external depressions around each marginal labiate process. Fig. 5, SEM, areolae tend to be fasciculated, a cluster of 7 areolae at the center of the valve, narrow marginal hyaline ring between the valve face and the mantle. Fig. 6, SEM, mantle with 6 alternating rings of small, oval areolae. Scale= 5 µm.

Fig. 1, LM, aréolas con tendencia a formar fascículos. Fig. 2, LM, margen valvar ondulado, con procesos labiados muy notorios. Fig. 3, LM, centro de la valva con un grupo de 13 aréolas, anillo hialino marginal presente entre la cara valvar y el manto. Fig. 4, SEM, proceso labiado central y marginales de gran tamaño, note las depresiones externas alrededor de cada proceso labiado marginal. Fig. 5, SEM, aréolas con tendencia a formar fascículos, centro de la valva con un grupo de 7 aréolas, anillo hialino marginal angosto, ubicado entre la cara valvar y el manto. Fig. 6, SEM, manto con 6 anillos alternados de aréolas ovales, pequeñas. Escala= 5 µm.

Scanning electron microscopy

The valve is circular, 22.6 µm in diameter, with a flat face and a broad vertical mantle. The areolae on the valve (10-11 in 10 µm) tend to be fasciculated, with shorter rows running parallel to the primary radial row; at the center of the valve there is a cluster of seven areolae surrounded by a narrow and not well defined hyaline area. The internal foramen of each areola is raised on the valve surface. Another narrow hyaline ring is somewhat apparent between the valve and the mantle areolae. There are marked differences between the areolae pattern on the face of the valve and on the mantle. The mantle presents six alternating rings of areolae, which are oval in outline and smaller in size that those on the valve face (20 in 10 µm). The valve exhibits a single subcentral labiate process located on the edge of the hyaline ring, and a marginal ring of labiate processes (5.6-6.6 µm distant) positioned on the inner ring of the mantle areolae. All labiate processes are large and projected internally by a broad and elongated neck, with a coarse rim surrounding the opening; externally there is a deep, ovoid depression around the circular opening of each marginal labiate process.

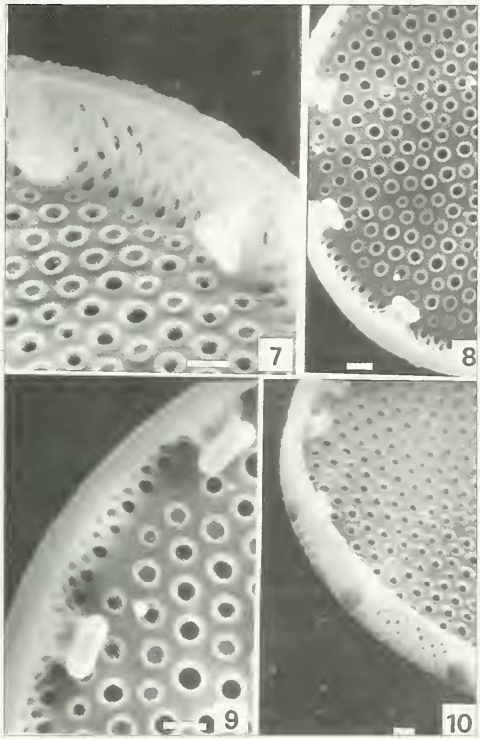

Fig. 7, SEM, the marginal labiate processes are positioned on the first row of mantle areolae. Figs. 8-9, SEM, labiate processes projected internally by a broad and elongate neck. Fig. 10, SEM, ovoid external depressions of the mantle around the circular opening of each labiate process. Scale= 1 µm.

Fig. 7, SEM, procesos labiados marginales ubicados sobre la primera línea de aréolas del manto. Figs. 8-9, SEM, procesos labiados levantados internamente por un ancho y largo cuello. Fig. 10, SEM, depresiones ovoides del manto rodean externamente la abertura circular de cada proceso labiado. Escala= 1 µm.

DISCUSSION

Considering the geographical position of the area where the sample studied was collected (Pacific Ocean at 39°58'S), it would be expected that the *Azpeitia* species found therein, would have had the morphological features corresponding to *A. tabularis* (Grunow) Fryxell & Sims. This taxon is present in cold water masses from the southern Atlantic and southern Indian Oceans, and in the southern Pacific Ocean in the Antarctic Zone, being still more abundant in the Subantarctic Zone (Heiden & Kolbe, 1928; Hustedt, 1958; Manguin, 1960; Cassie, 1963; Hasle, 1969; Fenner *et al.*, 1976; Schrader, 1976; Fryxell *et al.*, 1986). On the other hand, and according to Fryxell *et al.* (1986), the remaining taxa of this genus exhibit a typical warm water distribution.

However, it seems to us that characteristics observed in our valves from the South Pacific Ocean cannot be so readily attributed to the afore mentioned species. According to Hustedt (1958) and Fryxell *et al.* (1986), *A. tabularis* has a diameter which varies from 16 to 70 µm, the areolae are arranged in radial rows (5-9 in 10 µm), the labiate processes lack or have a very little neck or internal tube, the distance between the marginal labiate processes fluctuates between 7 and 12 µm, and the processes present a very slightly subcircular depression on the external side. Hasle & Syvertsen (1996) stressed that *A. tabularis* can be readily recognized with light microscopy by a hyaline ring close to the margin of the valve.

Although in our material the observed process pattern and the hyaline marginal ring are very similar to those of *A. tabularis*, the areolae on the valve are more dense (10-13 in 10 µm) and their distribution pattern tend to be fasciculated. Marked differences related to the labiate processes are also recognized. Internally, they show a broad and well developed neck, and externally, a deep oval depression on the mantle. The distance between the marginal processes is also smaller, about 5-6.6 µm. Also, the hyaline ring between the valve face and the mantle is very narrow (about 0.3-0.7 µm wide). From the SEM photographs of *A. tabularis* published by Fryxell *et al.*, 1986 (Pl. XIV, Figs. 1C, 2, 3B; Pl. XV, Figs. 2, 4A), we recognize that in this case, the hyaline ring is noteworthy wider, about 1.5-2 µm.

The morphological characteristics of our individuals seem to be more closely related to those of *A. neocrenulata* (VanLandingham) Fryxell & Watkins. In effect, the distribution and number of areolae on the valve face and on the mantle (19-20 striae in 10 µm), the internal projection of the labiate processes as a well differentiated neck, and the external, deep oval depression of the mantle around the processes, giving a scalloped appearance as seen clearly in LM, are all morphological features which correspond to *A. neocrenulata*, and which are also observed in our material (Table 1).

TABLE 1. Comparison of the main morphological features of *A. tabularis* and *A. neocrenulata* with those present in our material collected in the SE Pacific Ocean waters.

TABLA I. Comparación de las principales características morfológicas de *A. tabularis* y *A. neocrenulata* con aquéllas presentes en nuestro material recolectado en aguas del océano Pacífico suroriental.

	A. tabularis	*A. neocrenulata*	present study
Diameter (µm)	16 - 70	13 - 48	22.6 - 24.5
Valve areolae in 10 µm	5 - 9	10 - 11	10 - 13
Valve areolae pattern	radial	tend to be in fascicles	tend to be in fascicles
Hyaline ring close margin	present	absent	present
Depressions on valve mantle	slight, circular	deep, ovoid	deep, ovoid
Mantle striae in 10 µm	18	20	19 - 20
Labiate processes	with little or no neck	with small neck	with well developed neck
Distance betw. marginal labiate processes (µm)	7 - 12	4 -7	5 - 6.6

A. neocrenulata is a recent warm water species found in plankton from the Gulf of Mexico, and Central Pacific and Indian Ocean. However, Fenner *et al.* (1976) have also reported this species as a very uncommon taxon from a sample collected in the South Pacific Ocean at 52°59'S-77°30'W (as *Coscinodiscus crenulatus* Grunow). Their description agrees very well with the features observed by us in the sample reported herein. Dr. G.A. Fryxell, on account of the fine structure of the valve and processes (specially by the marked neck of the labiate processes and the ovoid depressions on the external side of the mantle) has told us that these characteristics satisfy the criteria to define our material as *A. neocrenulata* (personal communication). She has also indicated that several specimens found in the southern Indian Ocean had her concerned about the distinctions between *A. neocrenulata* and *A. tabularis*.

The presence in our individuals of a narrow marginal hyaline ring close to the mantle (best observed in LM), indicates that this morphological feature should not be used as the only distinctive character for the identification of *A. tabularis*.

Other species identified in this sample, with very low density values, were the diatoms *Thalassiothrix antarctica* Shimper ex Karsten, *Roperia tesellata* (Roper) Grunow ex Pelletan, *Pseudo-nitzschia australis* Frenguelli, and the silicoflagellate *Dictyocha fibula* Ehrenberg. All these taxa have been previously reported as common in the plankton of southern Chile.

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